Implementing an Antibiotic Stewardship Program: Guidelines by the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America


Evidence-based guidelines for implementation and measurement of antibiotic stewardship interventions in inpatient populations including long-term care were prepared by a multidisciplinary expert panel of the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America. The panel included clinicians and investigators representing internal medicine, emergency medicine, microbiology, critical care, surgery, epidemiology, pharmacy, and adult and pediatric infectious diseases specialties. These recommendations address the best approaches for antibiotic stewardship programs to influence the optimal use of antibiotics.

Keywords. antibiotic stewardship; antibiotic stewardship programs; antibiotics; implementation.

EXECUTIVE SUMMARY

Antibiotic stewardship has been defined in a consensus statement from the Infectious Diseases Society of America (IDSA), the Society for Healthcare Epidemiology of America (SHEA), and the Pediatric Infectious Diseases Society (PIDS) as “coordinated interventions designed to improve and measure the appropriate use of [antibiotic] agents by promoting the selection of the optimal [antibiotic] drug regimen including dosing, duration of therapy, and route of administration” [1]. The benefits of antibiotic stewardship include improved patient outcomes, reduced adverse events including Clostridium difficile infection (CDI), improvement in rates of antibiotic susceptibilities to targeted antibiotics, and optimization of resource utilization across the continuum of care. IDSA and SHEA strongly believe that antibiotic stewardship programs (ASPs) are best led by infectious disease physicians with additional stewardship training.

Summarized below are the IDSA/SHEA recommendations for implementing an ASP. The expert panel followed a process used in the development of other IDSA guidelines, which included a systematic weighting of the strength of recommendation and quality of evidence using the GRADE (Grading of Recommendations Assessment, Development, and Evaluation) system (Figure 1) [2-5]. A detailed description of the methods, background, and evidence summaries that support each of the recommendations can be found online in the full text of the guidelines. For the purposes of this guideline, the term antibiotic will be used instead of antimicrobial and should be considered synonymous.

RECOMMENDATIONS FOR IMPLEMENTING AN ANTIBIOTIC STEWARDSHIP PROGRAM

Interventions

I. Does the Use of Preauthorization and/or Prospective Audit and Feedback Interventions by ASPs Improve Antibiotic Utilization and Patient Outcomes?

Recommendation

1. We recommend preauthorization and/or prospective audit and feedback over no such interventions (strong recommendation, moderate-quality evidence).
Comment: Preauthorization and/or prospective audit and feedback improve antibiotic use and are a core component of any stewardship program. Programs should decide whether to include one strategy or a combination of both strategies based on the availability of facility-specific resources for consistent implementation, but some implementation is essential.

II. Is Didactic Education a Useful Antibiotic Stewardship Intervention for Reducing Inappropriate Antibiotic Use?

**Recommendation**

2. We suggest against relying solely on didactic educational materials for stewardship (weak recommendation, low-quality evidence).

Comment: Passive educational activities, such as lectures or informational pamphlets, should be used to complement other stewardship activities. Academic medical centers and teaching hospitals should integrate education on fundamental antibiotic stewardship principles into their pre-clinical and clinical curricula.

III. Should ASPs Develop and Implement Facility-Specific Clinical Practice Guidelines for Common Infectious Diseases Syndromes to Improve Antibiotic Utilization and Patient Outcomes?

**Recommendation**

3. We suggest ASPs develop facility-specific clinical practice guidelines coupled with a dissemination and implementation strategy (weak recommendation, low-quality evidence).

Comment: Facility-specific clinical practice guidelines and algorithms can be an effective way to standardize prescribing practices based on local epidemiology. ASPs should develop those guidelines, when feasible, for common infectious diseases syndromes. In addition, ASPs should be involved in writing clinical pathways, guidelines, and order sets that address antibiotic use and are developed within other departments at their facility.
**IV. Should ASPs Implement Interventions to Improve Antibiotic Use and Clinical Outcomes That Target Patients With Specific Infectious Diseases Syndromes?**

**Recommendation**

4. We suggest ASPs implement interventions to improve antibiotic use and clinical outcomes that target patients with specific infectious diseases syndromes (weak recommendation, low-quality evidence).

Comment: ASP interventions for patients with specific infectious diseases syndromes can be an effective way to improve prescribing because the message can be focused, clinical guidelines and algorithms reinforced, and sustainability improved. ASPs should regularly evaluate areas for which targeted interventions are needed and adapt their activities accordingly. This approach is most useful if the ASP has a reliable way to identify patients appropriate for review.

**V. Should ASPs Implement Interventions Designed to Reduce the Use of Antibiotics Associated With a High Risk of CDI?**

**Recommendation**

5. We recommend antibiotic stewardship interventions designed to reduce the use of antibiotics associated with a high risk of CDI compared with no such intervention (strong recommendation, moderate-quality evidence).

Comment: The goal of reducing CDI is a high priority for all ASPs and should be taken into consideration when crafting stewardship interventions.


**Recommendation**

6. We suggest the use of strategies (eg, antibiotic time-outs, stop orders) to encourage prescribers to perform routine review of antibiotic regimens to improve antibiotic prescribing (weak recommendation, low-quality evidence).

Comment: Published data on prescriber-led antibiotic review are limited, but successful programs appear to require a methodology that includes persuasive or enforced prompting. Without such a mechanism, these interventions are likely to have minimal impact.

**VII. Should Computerized Clinical Decision Support Systems Integrated Into the Electronic Health Record at the Time of Prescribing be Incorporated as Part of ASPs to Improve Antibiotic Prescribing?**

**Recommendation**

7. We suggest incorporation of computerized clinical decision support at the time of prescribing into ASPs (weak recommendation, moderate-quality evidence).

Comment: Computerized clinical decision support for prescribers should only be implemented if information technology resources are readily available. However, computerized surveillance systems that synthesize data from the electronic health record and other data sources can streamline the work of ASPs by identifying opportunities for interventions.

**VIII. Should ASPs Implement Strategies That Promote Cycling or Mixing in Antibiotic Selection to Reduce Antibiotic Resistance?**

**Recommendation**

8. We suggest against the use of antibiotic cycling as a stewardship strategy (weak recommendation, low-quality evidence).

Comment: Available data do not support the use of antibiotic cycling as an ASP strategy, and further research is unlikely to change that conclusion. Because clinical data are sparse for antibiotic mixing, we cannot give any recommendation about its utility.

**Optimization**

**IX. In Hospitalized Patients Requiring Intravenous (IV) Antibiotics, Does a Dedicated Pharmacokinetic (PK) Monitoring and Adjustment Program Lead to Improved Clinical Outcomes and Reduced Costs?**

**Recommendations**

9. We recommend that hospitals implement PK monitoring and adjustment programs for aminoglycosides (strong recommendation, moderate-quality evidence).

10. We suggest that hospitals implement PK monitoring and adjustment programs for vancomycin (weak recommendation, low-quality evidence).

Comment: PK monitoring and adjustment programs can reduce costs and decrease adverse effects. The ASP should encourage implementation and provide support for training and assessment of competencies. The conduct of those programs should be integrated into routine pharmacy activities.

**X. In Hospitalized Patients, Should ASPs Advocate for Alternative Dosing Strategies Based on PK/Pharmacodynamic Principles to Improve Outcomes and Decrease Costs for Broad-Spectrum β-Lactams and Vancomycin?**

**Recommendation**

11. In hospitalized patients, we suggest ASPs advocate for the use of alternative dosing strategies vs standard dosing for broad-spectrum β-lactams to decrease costs (weak recommendation, low-quality evidence).

Comment: Although data for improved outcomes for broad-spectrum β-lactam dosing with this approach are still limited, these interventions are associated with antibiotic cost savings. ASPs should consider implementation but must take into account logistical issues such as nursing and pharmacy education and need for dedicated IV access. Considering the limited evidence, we cannot give any...
recommendation about the utility of alternative dosing strategies for vancomycin.

XI. Should ASPs Implement Interventions to Increase Use of Oral Antibiotics as a Strategy to Improve Outcomes or Decrease Costs?  
**Recommendation**

12. We recommend ASPs implement programs to increase both appropriate use of oral antibiotics for initial therapy and the timely transition of patients from IV to oral antibiotics (strong recommendation, moderate-quality evidence).

Comment: Programs to increase the appropriate use of oral antibiotics can reduce costs and length of hospital stay. IV-to-oral conversion of the same antibiotic is less complicated than other strategies and is applicable to many healthcare settings. The conduct of those programs should be integrated into routine pharmacy activities. ASPs should implement strategies to assess patients who can safely complete therapy with an oral regimen to reduce the need for IV catheters and to avoid outpatient parenteral therapy.

XII. In Patients With a Reported History of β-Lactam Allergy, Should ASPs Facilitate Initiatives to Implement Allergy Assessments With the Goal of Improved Use of First-Line Antibiotics?  
**Recommendation**

13. In patients with a history of β-lactam allergy, we suggest that ASPs promote allergy assessments and penicillin (PCN) skin testing when appropriate (weak recommendation, low-quality evidence).

Comment: Allergy assessments and PCN skin testing can enhance use of first-line agents, but it is largely unstudied as a primary ASP intervention; however, ASPs should promote such assessments with providers. In facilities with appropriate resources for skin testing, the ASPs should actively work to develop testing and treatment strategies with allergists.

XIII. Should ASPs Implement Interventions to Reduce Antibiotic Therapy to the Shortest Effective Duration?  
**Recommendation**

14. We recommend that ASPs implement guidelines and strategies to reduce antibiotic therapy to the shortest effective duration (strong recommendation, moderate-quality evidence).

Comment: Recommending a duration of therapy based on patient-specific factors is an important activity for ASPs. Suitable approaches include developing written guidelines with specific suggestions for duration, including duration of therapy recommendations as part of the preauthorization or prospective audit and feedback process, or specifying duration at the time of antibiotic ordering (eg, through an electronic order entry system).

Microbiology and Laboratory Diagnostics

XIV. Should ASPs Work With the Microbiology Laboratory to Develop Stratified Antibiograms, Compared With Nonstratified Antibiograms?  
**Recommendation**

15. We suggest development of stratified antibiograms over solely relying on nonstratified antibiograms to assist ASPs in developing guidelines for empiric therapy (weak recommendation, low-quality evidence).

Comment: Although there is limited evidence at this time that stratified antibiograms (eg, by location or age) lead to improved empiric antibiotic therapy, stratification can expose important differences in susceptibility, which can help ASPs develop optimized treatment recommendations and guidelines.

XV. Should ASPs Work With the Microbiology Laboratory to Perform Selective or Cascade Reporting of Antibiotic Susceptibility Test Results?  
**Recommendation**

16. We suggest selective and cascade reporting of antibiotics over reporting of all tested antibiotics (weak recommendation, low-quality evidence).

Comment: Although data are limited that demonstrate direct impact of those strategies on prescribing, some form of selective or cascaded reporting is reasonable. After implementation, ASPs should review prescribing to ensure there are no unintended consequences.

XVI. Should ASPs Advocate for Use of Rapid Viral Testing for Respiratory Pathogens to Reduce the Use of Inappropriate Antibiotics?  
**Recommendation**

17. We suggest the use of rapid viral testing for respiratory pathogens to reduce the use of inappropriate antibiotics (weak recommendation, low-quality evidence).

Comment: Although rapid viral testing has the potential to reduce inappropriate use of antibiotics, results have been inconsistent. Few studies have been performed to assess whether active ASP intervention would improve those results.

XVII. Should ASPs Advocate for Rapid Diagnostic Testing on Blood Specimens to Optimize Antibiotic Therapy and Improve Clinical Outcomes?  
**Recommendation**

18. We suggest rapid diagnostic testing in addition to conventional culture and routine reporting on blood specimens if combined with active ASP support and interpretation (weak recommendation, moderate-quality evidence).

Comment: Availability of rapid diagnostic tests is expected to increase; thus, ASPs must develop processes and interventions to assist clinicians in interpreting and responding appropriately to results.
XVIII. In Adults in Intensive Care Units (ICUs) With Suspected Infection, Should ASPs Advocate Procalcitonin (PCT) Testing as an Intervention to Decrease Antibiotic Use?

Recommendation

19. In adults in ICUs with suspected infection, we suggest the use of serial PCT measurements as an ASP intervention to decrease antibiotic use (weak recommendation, moderate-quality evidence).

Comment: Although randomized trials, primarily in Europe, have shown reduction in antibiotic use through implementation of PCT algorithms in the ICU, similar data are lacking for other regions including the United States where the patterns of antibiotic prescribing and approach to stewardship may differ. If implemented, each ASP must develop processes and guidelines to assist clinicians in interpreting and responding appropriately to results, and must determine if this intervention is the best use of its time and resources.

XIX. In Patients With Hematologic Malignancy, Should ASPs Advocate for Incorporation of Nonculture-Based Fungal Markers in Interventions to Optimize Antifungal Use?

Recommendation

20. In patients with hematologic malignancy at risk of contracting invasive fungal disease (IFD), we suggest incorporating nonculture-based fungal markers in ASP interventions to optimize antifungal use (weak recommendation, low-quality evidence).

Comment: ASPs with an existing intervention to optimize antifungal use in patients with hematologic malignancy can consider algorithms incorporating nonculture-based fungal markers. Those interventions must be done in close collaboration with the primary teams (eg, hematology-oncology). Antibiotic stewards must develop expertise in antifungal therapy and fungal diagnostics for the programs to be successful. The value of those markers for interventions in other populations has not been demonstrated.

Measurement

XX. Which Overall Measures Best Reflect the Impact of ASPs and Their Interventions?

Recommendation

21. We suggest monitoring antibiotic use as measured by days of therapy (DOTs) in preference to defined daily dose (DDD) (weak recommendation, low-quality evidence).

Comment: Every ASP must measure antibiotic use, stratified by antibiotic. DOTs are preferred, but DDDs remain an alternative for sites that cannot obtain patient-level antibiotic use data. ASPs should consider measurement of appropriate antibiotic use within their own institutions by examining compliance with local or national guidelines, particularly when assessing results of a targeted intervention, and share that data with clinicians to help inform their practice. Although rates of CDI or antibiotic resistance may not reflect ASP impact (because those outcomes are affected by patient population, infection control, and other factors), those outcomes may also be used for measurement of targeted interventions.

XXI. What is the Best Measure of Expenditures on Antibiotics to Assess the Impact of ASPs and Interventions?

Recommendation

22. We recommend measuring antibiotic costs based on prescriptions or administrations instead of purchasing data (good practice recommendation).

XXII. What Measures Best Reflect the Impact of Interventions to Improve Antibiotic Use and Clinical Outcomes in Patients With Specific Infectious Diseases Syndromes?

Recommendation

23. Measures that consider the goals and size of the syndrome-specific intervention should be used (good practice recommendation).

Special Populations

XXIII. Should ASPs Develop Facility-Specific Clinical Guidelines for Management of Fever and Neutropenia (F&N) in Hematology-Oncology Patients to Reduce Unnecessary Antibiotic Use and Improve Outcomes?

Recommendation

24. We suggest ASPs develop facility-specific guidelines for F&N management in hematology-oncology patients over no such approach (weak recommendation, low-quality evidence).

Comment: Clinical guidelines with an implementation and dissemination strategy can be successfully used in the care of cancer patients with F&N and are strongly encouraged.

XXIV. In Immunocompromised Patients Receiving Antifungal Therapy, do Interventions by ASPs Improve Utilization and Outcomes?

Recommendation

25. We suggest implementation of ASP interventions to improve the appropriate prescribing of antifungal treatment in immunocompromised patients (weak recommendation, low-quality evidence).

Comment: In facilities with large immunocompromised patient populations, ASP interventions targeting antifungal therapy can show benefit. Those interventions must be done in close collaboration with the primary teams (eg hematology-oncology, solid organ transplant providers). Antibiotic stewards must develop expertise in antifungal therapy and fungal diagnostics for the programs to be successful.
XXV. In Residents of Nursing Homes and Skilled Nursing Facilities, do Antibiotic Stewardship Strategies Decrease Unnecessary Use of Antibiotics and Improve Clinical Outcomes?

**Recommendation**

26. In nursing homes and skilled nursing facilities, we suggest implementation of antibiotic stewardship strategies to decrease unnecessary use of antibiotics (good practice recommendation).

Comment: Implementing ASPs at nursing homes and skilled nursing facilities is important and must involve point-of-care providers to be successful. The traditional physician–pharmacist team may not be available on-site, and facilities might need to investigate other approaches to review and optimize antibiotic use, such as obtaining infectious diseases expertise through telemedicine consultation.

XXVI. In Neonatal Intensive Care Units (NICUs), do Antibiotic Stewardship Interventions Reduce Inappropriate Antibiotic Use and/or Resistance?

**Recommendation**

27. We suggest implementation of antibiotic stewardship interventions to reduce inappropriate antibiotic use and/or resistance in the NICU (good practice recommendation).

XXVII. Should ASPs Implement Interventions to Reduce Antibiotic Therapy in Terminally Ill Patients?

**Recommendation**

28. In terminally ill patients, we suggest ASPs provide support to clinical care providers in decisions related to antibiotic treatment (good practice recommendation).

**Notes**

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